OCCASIONAL PAPER NO. 91

MAY 8, 1940

SOUTHERN FOREST EXPERIMENT STATION

E. L. Demmon, Director

New Orleans, La.

DISTRIBUTION AND SUGGESTED CONTROL MEASURES FOR THE SOUTHERN PINE FUSIFORM RUST

by

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in cooperation with the Southern Forest Experiment Station,
Forest Service, U.S. Department of Agriculture

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Control work on the fusiform rust canker disease of southern pine caused by the pine-oak rust fungus Cronartium fusiforme (A. and K.) Hedgc. and Hunt was initiated in 1937. A paper 2/ describing the disease and illustrated with photographs to aid in its recognition was released the same year. The present paper summarizes the situation as it is now known.

The common rust of slash pine (Pinus Caribaea Morel.) loblolly pine (P. taeda L.) and longleaf pine (P. palustris Mill.) is familiar to the woodsmen and foresters of the Gulf and South Atlantic States as elongated or spindle-shaped cankers on the branches and stems of seedlings, saplings and larger trees. The spherical type of canker caused by the closely related C. cerebrum Hedgc. and Long occurs infrequently in that part of the southern states in which the fusoid type of canker is common, and for this reason the latter is considered the typical canker occuring in the area and will be referred to in this paper as caused by C. fusiforme.

Susceptibility of pines and oaks to rust infection

It has been observed consistently that slash pine and loblolly pine are the two pines most susceptible to infection by C. fusiforme and in most areas where these two species were growing together, slash pine was apparently more susceptible than loblolly pine. Longleaf pine is relatively resistant to infection under most circumstances. Stands of longleaf pine with more than 10 percent of the trees infected have been reported infrequently, while in a majority of the stands examined less than 5 percent of the trees were infected. Shortleaf pine (P. echinata Mill.) which is commonly affected with the cerebroid type of canker is apparently highly resistant to infection by C. fusiforme for no fusiform cankers have been observed on this species.

The oaks range from very high to very low susceptiblity to infection by C. fusiforme as measured by telia production. As a group the black oaks are more susceptible to infection than the white oaks. Water oak (Quercus nigra L.), and willow oak (Q. phellos L.), are highly susceptible to rust infection and are considered to be the most abundant telia producers of the oaks. Other oaks in descending order of telia production are laurel oak (Q. laurifolia Michx.), blackjack oak (Q. marilandica Meunch.), blue-jack oak (Q. cinerea Michx.) and southern red oak (Q. rubra L.). Production of telia on turkey oak (Q. catesbaei Michx.) is relatively small. The white oaks have few if any telia. Q. alba L.,

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1/ Forest Pathology Contribution 40-17.
2/ Lamb, Howard. Rust canker diseases of southern pines.
U.S.D.A. Forest Service, Southern Forest Experiment Station,
Occasional Paper No. 72. December 27, 1937.

and Q. stellata Wang, are usually free of telia, although an occasional individual Q. alba tree may be found that has numerous telia. The live oak (Q. virginiana Miller) bears few if any telia, although information on its susceptibility to infection is meager.

Rust canker survey

Considerable time has been spent in conducting an extensive survey in the Gulf and South Atlantic States to determine the extent of the fusiform rust disease and damage resulting from infection in nurseries, plantation and stands of natural reproduction. The pertinent information gathered is given on a map, (Fig. 1)., which shows the approximate range of C. fusiforme and zones or extensive areas of heavy, medium and light infection based mainly on examination of slash and loblolly pine. The map is a composite of information on rust infection collected from nurseries, plantations and young stands of natural reproduction. The lines delimiting the various zones of infection should be considered as approximate and which may be changed with the accumulation of additional data.

The percentage of infected trees was found to range from less than 1 percent in some local areas in zone 3 to more than 80 percent in certain local areas in zone 1. Heaviest infection and losses were observed in southeast Louisiana, south Mississippi and south Alabama, zone 1, Fig. 1. Stands of slash and loblolly pine with less than 10 percent infection occasionally were found in zone 1, but most of the stands examined had from 20-50 percent of the trees infected and a few stands had as high as 80 percent of the trees infected. Infection of longleaf pine was higher in zone 1 than elsewhere, although seldom more than 10 percent of a stand were infected. Stands of slash and loblolly pine in zone 2 had a lower average percentage of rust infected trees than similar stands in zone 1. Infection in this zone ranged from less than 1 percent to as much as 50 percent in various stands examined while the average was between 5 and 30 percent with the more heavily infected stands in southern Georgia, northern Florida and southern South Carolina. Zone 3 is the most extensive of the three zones and includes an area west of the Mississippi River and the northern parts of the Gulf and South Atlantic States including a considerable portion of Florida. Rust infection in pine stands in this zone was usually less than 5 percent.

The presence of the rust disease in southern pine nurseries was first demonstrated in 1937. A survey made that year and in 1938 and 1939 revealed serious infections in several nurseries. Losses of nursery stock have been greatest in zone 1, where 15 to 35 percent of the slash pine seedlings in several nurseries were infected with rust. Although infection of longleaf pine seedlings has been less than that of slash pine, infections of 10 to 15 percent of the longleaf pine seedlings have occurred in several nurseries, and losses of 2 to 5 percent have been common. Rust infection has been less severe in nurseries located in zones 2 and 3 than in zone 1. Also the disease was much more severe in nurseries in 1938 and 1939 than in 1937; this was probably because conditions for pine seedling infection were less favorable in 1937 than in the following 2 years. However, with the increase in number of oaks in the South it is probable that the level of infection hazard has been on the increase in recent years.

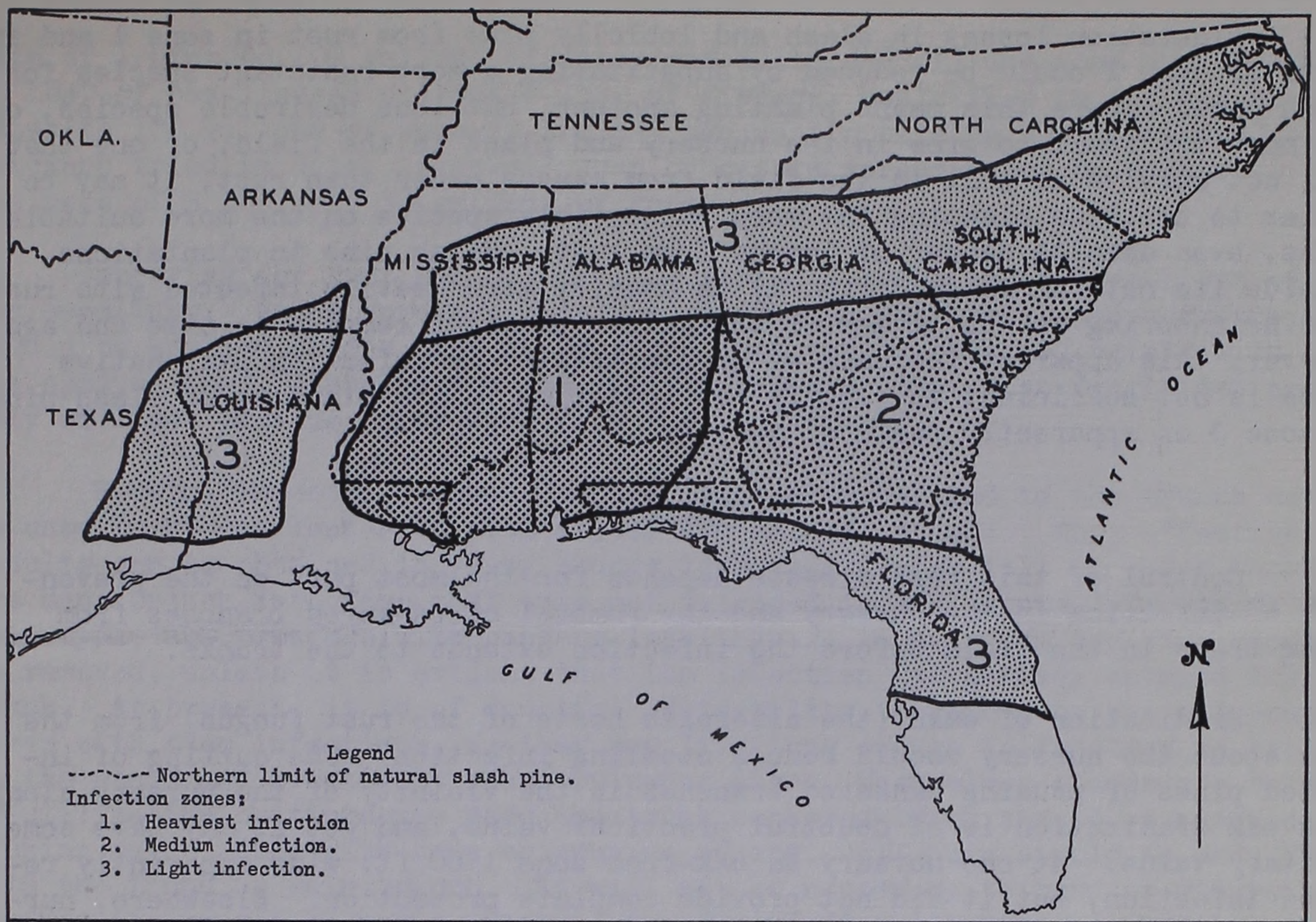

Figure 1. – Map showing range and infection intensity of fusiform rust disease of southern pines and approximate northern range of slash pine. The map is based mainly on information secured in 1938 and 1939 from plantations, natural reproduction and forest tree nurseries. Some changes may be expected to the zone boundaries as additional observations are made.

Damage caused by the rust canker disease

Mortality from rust infection is highest in the seedling stage and young stands and least in the mature stand. Seedlings infected in the nursery are considered a total loss because they will die within a few years if planted in the field. Young seedlings and saplings with trunk infections are either killed by the disease or so badly damaged as to become worthless, particularly slash pine. Older trees with trunk cankers may continue to live for a number of years after infection takes place, although the trunks may be seriously injured, such trees frequently seem to grow almost as well as uninfected ones nearby. However, trunk cankered trees frequently break over during storms. Trunk cankers are less serious on loblolly pine than on slash pine. Branch cankers that never reach the trunk are thought to cause little or no damage to the tree.

Losses in plantations and natural stands depend on many factors, such as age of stand, intensity of infection, number of trunk infections, and utilization and management practices. Losses that would be negligible or perhaps in some cases even beneficial in heavily stocked natural stands, are serious in plantations, where there are fewer trees per acre and the loss of a part of them would result in an understocked stand. It will be possible, in many instances, to salvage many infected trees for pulpwood when the stands are thinned or when improvement cuttings are made in this way losses attributable to rust may be reduced.

Plantation losses in slash and loblolly pine from rust in zone 1 and in parts of zone 2 could be reduced by substituting a more resistant species for slash pine. Where this means planting another, but less desirable species, or one more difficult to grow in the nursery and plant in the field, or one that will not survive as well in the field from causes other than rust, it may be better to continue planting the more susceptible species on the more suitable sites, even despite danger of losses from rust. Slash pine in plantations, outside its natural range, (Fig. 1) is usually more heavily infected with rust than neighboring stands of any of the native pines of comparable size and age. However, this apparent increase of susceptibility to infection over native pines is not sufficient to justify any reduction in the planting of slash pine in zone 3 or apparently parts of zone 2.

Control

Control of this rust disease depends for the most part on the prevention of infection in the nursery and the removal of cankered branches from young trees in the field before the infection extends to the trunks.

Eradication of oaks (the alternate hosts of the rust fungus) from the area about the nursery should reduce seedling infection. The cutting of infected pines or pruning cankered branches in the vicinity of the nursery along with oak eradication is of doubtful practical value, and yet it may have some sanitary value. At one nursery an oak-free zone 1500 ft. wide apparently reduced infection, but it did not provide complete protection. Elsewhere, nurseries with partially oak-free zones gave little or no indication of benefit. Because of the difficulty of checking the effectiveness of oak eradication definite conclusions cannot be made on the observations to date. Under most circumstances the removal of the more susceptible oaks near the nursery should help in reducing infection, but in most places sufficient protection to the nursery probably will not be secured to justify the cost of establishing an extensive oak-free zone unless the eradication can be combined with an utlization operation, such as one for saw logs, fire wood and posts, or where the oaks are relatively scarce in the vicinity.

From observations made in 1938 and from results obtained in several nurseries in 1939 it seems that a combination of late sowing and early and thorough spraying gives promise of controlling or greatly reducing rust infection in nursery stock. It has been demonstrated that rust infection in a given nursery is lower in beds of slash pine sown late than in beds of the same species sown earlier. Seeding should be as late as possible without endangering the production of plantable stock; each nurseryman will known the latest date that will permit economical production of good stock in his nursery. Where infection has been sufficient to warrant preventive measures, spraying should start as soon as the burlap or other cover is removed from the seedbeds or when the uredia appear in vicinity of nursery and should be continued until June 1, with at least one spray application each week. In nurseries where past experience indicates danger of heavy rust infection, it may be desirable to spray the burlap or other cover on the seedbeds at least once between the first emergence and the removal of the burlap or other cover. In such nurseries it will also be desirable to spray at intervals of 3-4 days (twice a week) for the first 3 weeks after the removal of the burlap. A 4-4-50 Bordeaux mixture, preferably homemade, with a good sticker and spreader added, is recommended as a spray. On a trial basis only, liquid lime sulfur 1-50 has been suggested in place of Bordeaux mixture. Liquid Santomerse used at the

rate of 1 pint to 100 gallons of spray and a linseed oil and soap emulsion (6 lbs. of raw linseed oil and 6 lbs. of fish-oil emulsified in 6 pints of water to 100 gallons of spray), are the two most promising spreaders and stickers tried to date. Fish-oil soap or casein spreader may be used at the rate of 3 lbs. per 50 gallons of spray.

Spraying for rust control must be thorough, covering all portions of the seedlings. Power sprayers should be used when available, and the spray should be applied at the highest pressure that can be obtained safely with the sprayer used. Results secured in 1939 indicate that dust fungicides probably will not provide protection from rust infection.

Pruning infected branches before the cankers extend to the trunks may be used to reduce losses in plantations and natural stands. Most effective results can be obtained in young stands less than 10 ft. tall in which there are many branch infections that have not extended to the trunks. In stands of this type, all branches with cankers less than 24 inches from the stem should be removed, unless it is evident that the infection has already entered the trunk. At present, it is of doubtful advisability to remove or cut out young trees with stem infections, as they may live long enough to function as trainers in the stand and eventually reach pulpwood size. When older stands are thinned or utilization cuttings are made the trunk cankered trees should be removed. Pruning may be done with saws or pruning shears. All cuts should be made flush with the trunk or main branch. It will not be necessary to burn or otherwise destroy the pruned branches, because the fungus dies with the severed branch. Pruning may be done at anytime in the year. In very young stands, 3-6 ft. high, it may be advisable to delay pruning until winter or early spring. By late winter many infections of the previous season will have developed into noticeable cankers that may be easily recognized and removed.

The shipment of seedlings from nurseries in the zone of heavy rust infection to areas where there is little or no rust on the native pines is a questionable practice because of the danger of introducing new, and perhaps more virulent strains of the rust fungus into such areas. When pine seedlings are lifted and graded, rust cankered seedlings should be culled out so as to minimize the danger of disseminating rust strains and to prevent the planting of worthless and diseased stock. It is highly probable that some infected trees will be included in shipments of seedlings from nurseries where infection is heavy. Even the most of the nursery infected seedlings will die before the cankers produce spores, a small percentage may live long enough to allow the cankers to fruit and thus provide a source of infection of the native oaks with a different or new rust strain for that area. It is usually undesirable to ship nursery stock for long distances, but if such shipments must be made it would seem preferable to ship pine seedlings from areas of light rust infection into areas equally or more heavily infected rather than to ship from a heavily infected zone into a less heavily infected one. While it has not been demonstrated that differences exist between strains of the rust fungi, it is probable that they do, and it would be highly undesirable to introduce virulent strains of the fungus into areas where there has been little or no loss from this disease.

Further information on this disease may be obtained from the Bureau of Plant Industry, Division of Forest Pathology, Southern Forest Experiment Station, New Orleans, La.